# THE ECONOMIC IMPACTS OF TOURISM ON ATHENS COUNTY

# AN INPUT-OUTPUT ANALYSIS

by

Muin Kakish, Resource Economist,
OSU, Columbus

and

George Morse, Resource Economist,
OSU, Columbus
(614-422-2701)

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and Rural Sociology

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# The Economic Impacts of Tourism on Athens County: An Input-Output Analysis

Tourism may offer one key to further economic development in Southeastern Ohio. The Athens Area Chamber of Commerce and the City of Athens have been exploring a variety of specific means to encourage tourism.

This study examines the multiplier effects of tourism in Athens County. Growth in tourism will increase purchases directly in certain recreation business, retail business, and service stations. In turn, these businesses will increase their purchases of goods and services from other local businesses. Thus, tourism indirectly increases income and jobs in a large number of other local businesses. The direct and indirect changes in Athens economy due to tourism are examined in this report.

This analysis was done as part of the Cooperative Extension Service's Community Economics Program. John Jones, Executive Secretary of the Athens Area Chamber of Commerce requested this analysis. Athena Chraiskis, Athens City-County Planning Office, provided the survey data on direct purchases by tourists.

## The Sales Multiplier for Tourism

The Athens economy is divided into 18 economic sectors.[1/] The estimated direct tourist purchases from each sector in Athens County are shown in column 1 of Table 1. For example, no tourist purchases were made from the livestock sector, while tourists purchases from wholesale trade were $619,000. The other sectors that sold directly to tourists are retail trade ($2,387,000); hotels ($1,263,000); eating and drinking ($5,849,000); and auto service stations ($616,000). These sectors will be called the "Tourism Sectors."

1/ Appendix A describes the activities of each sector.

The estimates of direct tourism purchases were derived from a county input-output model for Athens County and local estimates of the percentage of purchases in each sector going to tourists. The county input-output (I-O) model provided estimates of the total sales in each sector based on a non-survey I-O technique.2/

The basic assumption in this approach is that the productivity per worker in each Athens County business matches the national average. Results will vary with the degree that this assumption is in error.

The local data were provided by the Athens City County Planners Office. Appendix B discusses the input-output methodology used in this report.

The economic impacts of tourism extend beyond the direct purchases made by tourists from the tourism sectors. In order to meet the demand made by tourists, the tourism sectors will demand inputs from other local sectors. This occurs because of the interdependencies among the local economic sectors. For example, the demand by tourist for services from the hotels sector will require inputs to the hotels from the utilities sector in terms of gas and electricity, from printing, retail, wholesale, insurance, and so on. Column 2 of Table 1 shows the direct and indirect impacts of tourism on stimulating the output of each local sector. For example, indirectly tourism generates $47,000 in the livestock sector, although there is no direct purchases made by tourists from livestock. Because of the interdependencies in the regional economy, tourists purchases of meat, dairy products, and poultry products in the restaurants and grocery store stimulate demand for these products which will result in increasing the output of local dairy and poultry farms. Column

2/ For a complete description of the non-survey input-output model see Muin Kakish, "Economic Impact of Coal Changes and Other Industrial Development: A Regional and County Input-Output Analysis," unpublished Ph.D. Dissertation, The Ohio State University.

Table 1. Impact of Tourism on Athens County

| Sector | Direct Tourist Purchases ($1000) | Direct and Indirect Tourism Impact on Output ($1000) | Employment Man-years | Income ($1000) |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Livestock | 0 | 47 | 2 | 29 |
| Crops | 0 | 36 | 2 | 27 |
| Mining | 0 | 27 | 1 | 20 |
| Construction | 0 | 54 | 2 | 34 |
| Manufacturing | 0 | 617 | 21 | 337 |
| Printing | 0 | 28 | 3 | 19 |
| Transportation | 0 | 38 | 2 | 28 |
| Communication | 0 | 72 | 3 | 79 |
| Utilities | 0 | 368 | 8 | 283 |
| Wholesale Trade | 619 | 1,100 | 51 | 964 |
| Retail Trade | 2,387 | 2,409 | 304 | 2,124 |
| Finance | 0 | 546 | 17 | 443 |
| Hotels | 1,263 | 1,270 | 134 | 989 |
| Eating and Drinking | 5,849 | 5,907 | 189 | 3,631 |
| Auto Service Statfons | 616 | 656 | 15 | 400 |
| Recreation | 0 | 21 | 2 | 15 |
| Services | 0 | 483 | 20 | 387 |
| Government | 0 | 57 | 9 | 36 |
| TOTAL | 10,734 | 13,736 | 785 | 9,845 |

2 in Table 1 shows the total output (direct plus indirect) generated in Athens as a result of direct tourists purchases of $10.7 million.

Total output generated by tourism in Athens County amount to $13.7 million. This shows that every dollar spent by tourists will increase total purchases in the county by $1.28 ($13.7 million ÷ $10.7 million). In other words, the tourist dollar has a county sales or output multiplier of 1.28.

Multipliers exist for each economic sector. For example if a new tourist activity would increase direct purchases only in hotels and auto service station, this would be analyzed separately. The sales multipliers for each tourist sector are:

| Sector | Sales Multiplier |
|---|---|
| Wholesale Trade | 1.18 |
| Retail Trade | 1.18 |
| Hotels | 1.38 |
| Eating and Drinking | 1.32 |
| Auto Service Stations | 1.17 |
| Tourist Sectors | 1.28 |

Appendix C provides the sales multipliers for all sectors in Athens County.

## The Employment Impacts of Tourism

Naturally, tourism purchases also have impacts on employment and income. For example, for every additional one hundred thousand dollars directly spent in the hotels sector, the input-output analysis assumes 9.5 local jobs are created directly. But expansion in the hotels sector requires additional purchases from many other local sectors. When these indirect jobs are added

to those generated directly the total number of new jobs created by $100,000 of additional expenditures on hotels is 10.6.

Appendix D provides the total employment effect (direct plus indirect) for all sectors with an example on the use of total employment effect.

The total man-years of employment due to tourism in Athens County is estimated to be 785 (total in column 3 of Table 1). Note that while no jobs are generated directly in the first nine sectors by tourism, there are 44 jobs due to interactions with the tourism sectors.

## The Income Impacts of Tourism

Income that is generated by tourism is presented in column 4 of Table 1. Total income generated is approximately $9.8 million. The income effect (direct plus indirect) for the tourism sectors is .75. For each individual tourism sector the income effect is:

| Sector | Total Income Effect |
|---|---|
| Wholesale Trade | .88 |
| Retail Trade | .88 |
| Hotels | .78 |
| Eating and Drinking | .61 |
| Auto Service Station | .61 |
| Tourism Sector | .75 |

Appendix E shows total income effect for each sector with an example.

## Impact of Changes in Tourism

This section provides estimates of change in output, employment, and income associated with a 10 percent change (increase or decrease) in tourist purchases in the county. Table 2 presents the increase in output (column 1), employment (column 2), and income (column 3) by sector resulting from a 10%

Table 2. Impact of a 10% Increase in Tourist Purchases on the Athens County Economy

| Sectors | Total Increase Generated as a result of a 10 percent increase in Tourist Purchases | | |
|---|---|---|---|
| | Output ($1000) | Employment (Man-years) | Income ($1000) |
| Livestock | 4.7 | .2 | 2.9 |
| Crops | 3.6 | .2 | 2.7 |
| Mining | 2.7 | .1 | 2.0 |
| Construction | 5.4 | .2 | 3.5 |
| Manufacturing | 61.7 | 2.1 | 33.7 |
| Printing | 2.8 | .3 | 1.9 |
| Transportation | 3.8 | .2 | 2.8 |
| Communication | 7.2 | .3 | 7.9 |
| Utilities | 36.8 | .8 | 28.3 |
| Wholesale Trade | 110.0 | 5.1 | 96.4 |
| Retail Trade | 240.9 | 30.4 | 212.4 |
| Finance | 54.6 | 1.7 | 44.3 |
| Hotels | 127.0 | 13.4 | 98.9 |
| Eating and Drinking | 590.7 | 18.9 | 363.1 |
| Auto Service Station | 65.6 | 1.5 | 40.0 |
| Recreation | 2.2 | .2 | 1.5 |
| Services | 48.3 | 2.0 | 38.7 |
| Government | 5.7 | .9 | 3.6 |
| | 1,374.0 | 78.5 | 984.5 |

increase in tourism in the county. For example, hotels sector will witness an increase of approximately 13 jobs and $99 thousand in income. The impacts on total economy will be an increase in employment by approximately 79 jobs, and an increase in income by $985 thousand.

## Further Research Questions

### Estimation Issues

The estimates provided in this report could be refined in several ways. The data on direct purchases by tourists could be collected from a larger sample of local businesses.

Employment data from the County Business Patterns Tapes for each sector was used to estimate total output for each sector. This could be verified against local data sources.

### Policy Issues

Scenarios about additional tourist development can be easily analyzed using the data provided by Table 1 and 2 and the Appendixes. An example of this is shown in Appendix G. In fact the expansion or contraction of any industries can be studied in the same fashion.

## Feasibility of Tourist Activities

The most important unresolved questions on tourism center on markets.

(1) What is the effective demand for different types of tourist activities? That is, how many people are willing and able to pay for a tourist attraction at different prices?

(2) What factors affect demand for each type of tourism? How will these change in the 1980's?

(3) What are the costs of production for each tourist activity? At what price can a reasonable profit be made - say 10 to 15 percent?

## Conclusion

Tourism in Athens County accounts for approximately 6 percent of total employment and tourists spent approximately $11 million during 1980. A 10 percent increase in tourism would generate an estimated 79 new jobs and approximately a million dollars in income.

The retail trade, hotels, and eating and drinking sectors account for 80 percent of total generated employment by tourism and 69 percent of the total generated income. The input-output analysis (inter-industry analysis) shows that a dollar spent by tourists will generate $1.28 increase in total output of Athens County.

## Appendix A

### Economic Sector's Definitions

Livestock: includes dairy farm products, poultry and eggs products, and meat animals products

Crops: includes food and feed grains, fruits and vegetables products, greenhouse and nursery products, and miscellaneous crops

Mining: includes coal, petroleum and natural gas, stone and clay

Construction: includes general building and road construction contractors, special trade contractors (plumbing, heating, carpentry, etc.).

Manufacturing: includes food processing, fabricated textile products, lumber and wood, shoes and footwear, stone and clay products, fabricated metal products, machinery, and miscellaneous manufacturing.

Printing: includes newspaper publishing and commercial printing

Transportation: includes local passenger transportation, motor freight and warehousing and transportation services

Communication: includes radio and T.V. broadcasting and other communications

Utilities: includes electric and gas services, water supply and sanitary services

Wholesale Trade: includes food, furniture, textile, and drugs

Retail Trade: includes food (grocery), furniture, clothes, novelty, jewelry, gift, news stand, and shoes

Finance: includes banking, insurance agents, commodity and security brokers, and real estate agents.

Hotels: includes hotels, lodging places, and camp grounds

Eating and Drinking: includes restaurants and taverns

Auto Station Services: includes gasoline supplies and auto repairs and services

Recreation: motion picture theaters and amusement and recreation services

Services: includes beauty and barber shops, professional services (health, education, social); advertisement, and other miscellaneous business services

Government: local governments, county, town, village, and city, and federal government (postal services).

## Appendix B

## Methodology for Estimating the Direct Purchases in Tourist Sectors

### Total Direct Purchases

A non-survey input-output model was used to generate total purchases in all 18 sectors of the Athens economy. Input-output (I-O) provides a detailed description of the interdependence of the local economy and the interrelationship of its sectors. I-O is based on three basic assumptions: (1) constant production technology, (2) constant relative prices of inputs and outputs, and (3) homogeneous output in each sector. While these are not completely unrealistic over a short period, it "can only be a first approximation to the more complex production functions of the real world." (Chenery and Clark, 1959, p. 41).

A highly dessegregated national table (365 SIC sectors) was used to derive the regional results. This allows us to eliminate industries not in the county and to adjust the coefficients of these aggregated into one sector. The most recent national table available is for 1972. This was updated in 1978 by price indexes. The updated national table (365 sectors) was aggregated into 18 sectors using Athens' employment as regional weights.

Competitive inputs are estimated using the supply-demand pool approach.

Total output for each sector was estimated by multiplying the national output/worker times the number of employees in that sector in Athens. This implies that the productivity of Athens County workers is equivalent to the national average.

### Total Tourism Purchases

It was assumed that all tourist expenditures were in five sectors: (1) wholesale trade, (2) retail trade, (3) hotels, (4) eating and drinking

establishments and (5) automobile service stations.

Data on the percentage of sales by tourists in each of these sectors was obtained by Athena Chraiskis, Athens City-County Planning Office in collaboration with John Jones, Athens Area Chamber of Commerce.

A telephone survey was used to obtain answers to the following questions:

1. For an average year, roughly what percentage of your total sales comes from people who come in as tourists from outside Athens County?
2. What is the minimum percentage of your sales that are directly related to tourists?
3. What is the maximum percentage of your sales that are directly related to tourists?
4. What, in your estimation, would these percentages be for all _____ (hotels, retailers, restaurants, groceries, etc.)?

Table B.1 shows the percentage of total sales due to tourists. For example the four restaurants estimated that between 9.0 and 23.0 percent of all restaurant sales went to tourists. Note this is not the average for the four establishments surveyed but their estimate for all establishments in the county. The raw data is available at the Chamber of Commerce office or from the authors.

The total tourist purchases were then found as follows:

$$TTP_i = P_i * TE_i$$

where TTP = Total tourist purchases in sector i

P = percent of total expenditures in sector i by tourist

TE = total expenditures in sector i

Table B.1 Percentage of Sales Due to Tourist
Athens County, 1981

Calculate the mean value (average) for members in parenthesis and record as below:

| Sector | Sample Size | Estimated Percentage Low | Intermediate | High |
|---|---|---|---|---|
| Recreation Sector | | | | |
| A. Restaurants | 4 | 9.0% | 14.9% | 23.0% |
| B. Hotels/Motels/Lodges | 4 | 53.8 | 67.5 | 70.0 |
| C. Theatres | 1 | 0.0 | 1.0 | 2.0 |
| D. Taverns | 3 | 13.8 | 22.5 | 31.3 |
| E. Camp Grounds | 4 | 38.8 | 67.5 | 72.5 |
| Other Wholesale/Retail Sector | | | | |
| A. Retail | 4 | 4.5 | 13.8 | 17.5 |
| B. Specialty Shops | 4 | 15.0 | 21.3 | 25.0 |
| C. Wholesale | 2 | 1.0 | 5.0 | 6.0 |
| Service Station Sector | 3 | 11.7 | 25.0 | 33.3 |

Appendix C

Sectoral Sales Multiplier, Athens County 1980

| | Sector | Sales Multiplier |
|---|---|---|
| 1. | Livestock | 1.49 |
| 2. | Crops | 1.24 |
| 3. | Mining | 1.21 |
| 4. | Construction | 1.22 |
| 5. | Manufacturing | 1.19 |
| 6. | Printing | 1.18 |
| 7. | Transportation | 1.24 |
| 8. | Communication | 1.19 |
| 9. | Utilities | 1.44 |
| 10. | Wholesale Trade | 1.18 |
| 11. | Retail Trade | 1.18 |
| 12. | Finance | 1.41 |
| 13. | Hotels | 1.38 |
| 14. | Eating and Drinking | 1.32 |
| 15. | Auto Station Services | 1.17 |
| 16. | Recreation | 1.37 |
| 17. | Services | 1.26 |
| 18. | Government | 1.35 |

## Appendix D

### Sectoral Total Employment Effect, Athens County 1980

| Sector | Man-years per $1,000 | |
|---|---|---|
| | Direct | Direct & Indirect |
| Livestock | .035 | .051 |
| Crops | .038 | .045 |
| Mining | .024 | .030 |
| Construction | .035 | .045 |
| Manufacturing | .027 | .033 |
| Printing | .080 | .088 |
| Transportation | .037 | .045 |
| Communication | .026 | .033 |
| Utilities | .012 | .021 |
| Wholesale Trade | .040 | .046 |
| Retail Trade | .121 | .126 |
| Finance | .016 | .030 |
| Hotels | .096 | .106 |
| Eating and Drinking | .022 | .032 |
| Auto Station Servfces | .016 | .022 |
| Recreation | .065 | .079 |
| Services | .033 | .041 |
| Government | .148 | .159 |

An Example

Suppose that hotels sector's sales increase by $100,000. The employment generated in hotels will be:

100 x .096 = 9.6 job (man-years)

Total employment generated in the whole economy (including hotels) will be:

100 x .106 = 10.6 job (man-years)

This can be done to any other sector in the same fashion.

Appendix E

Sectoral Total Income Effect for Athens County, 1980

| Sector | Income Effect | |
|---|---|---|
| | Direct | Direct & Indirect |
| Livestock | .35 | .61 |
| Crops | .60 | .74 |
| Mining | .61 | .73 |
| Construction | .52 | .65 |
| Manufacturing | .44 | .55 |
| Printing | .58 | .69 |
| Transportation | .60 | .74 |
| Communication | .73 | .84 |
| Utilities | .52 | .77 |
| Wholesale Trade | .77 | .88 |
| Retail Trade | .78 | .88 |
| Finance | .57 | .81 |
| Hotels | .56 | .78 |
| Eating and Drinkfng | .43 | .61 |
| Auto Station Servic | .50 | .61 |
| Recreation | .48 | .69 |
| Services | .65 | .80 |
| Government | .43 | .63 |

An Example

Suppose that eating and drinking sales to tourists increased by $100,000. Direct income generated in the eating and drinking sector will be:

100,000 x .43 = $43,000

Total income generated (including the $43,000 generated in the eating and drinking) will be:

100,000 x .61 = $61,000.

## Appendix F

## Input-Output Tables from Athens County

### The Transactions Table

Table F-1 is the transactions table. It is arranged into rows and columns. Each row shows the sales made by the sector on the left-hand side to each sector on the top of table. For example Auto station services (Auto stat) sells $8800 to livestock $1800 to crops, $10,700 to mining, $12,000 to construction and so on. Each column shows the purchases of the sectors on top of table from each sector on the left-hand side of the table. For example, the livestock sector (Livestok) purchases $327,900 from itself, $472,900 from crops, $100 from mining, $12,100 from construction, $446,200 from manufacturing and so on.

### The Technical Coefficients Table

Table F-2 shows the technical coefficients for Athens County. To read this table pick a sector, say livestock and read down the column. The column shows the direct purchases required by the livestock industry from all other sectors (at the left of table) in order for the construction industry to produce one dollar of output (increases it sales by one dollar). For example, in order for the livestock industry to increase its final sales by one dollar it will buy 7 cents from itself, 10 cents from crops industry, 9 cents from manufacturing and so on.

This table is calculated from Table F-1. The transactions table. For example, livestock sector purchases $327,900 from itself, and total livestock purchases is $4,655,000. The livestock coefficient is:

$$\frac{327,900}{4,655,000} = .070434$$

F-1 - Transactions Table, Athens County, 1980

| | LIVESTOK | CROPS | MINING | CONSTRUT | MANUFACT | PRINTING | TRANSPRT | COMUNCAT | UTILITES | WHOLSALE |
|---|---|---|---|---|---|---|---|---|---|---|
| LIVESTOK | 327.9 | 23.9 | 0.0 | 0.0 | 498.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| CROPS | 472.2 | 15.6 | 0.0 | 1.7 | 4.1 | 0.1 | 0.0 | 0.1 | 1.2 | 0.7 |
| MINING | 0.1 | 1.4 | 58.6 | 18.2 | 106.5 | 0.1 | 0.0 | 0.0 | 2084.4 | 0.0 |
| CONSTRUT | 12.1 | 3.4 | 8.3 | 0.5 | 29.6 | 7.9 | 3.0 | 106.0 | 541.6 | 13.1 |
| MANUFACT | 446.2 | 1.9 | 16.2 | 261.6 | 1420.4 | 2.4 | 3.6 | 0.6 | 3.5 | 16.1 |
| PRINTING | 0.0 | 0.0 | 0.1 | 0.2 | 12.2 | 161.4 | 2.3 | 15.2 | 6.0 | 14.8 |
| TRANSPRT | 33.4 | 2.1 | 3.6 | 23.6 | 135.2 | 16.1 | 58.1 | 7.4 | 87.4 | 63.3 |
| COMUNCAT | 9.2 | 2.0 | 1.8 | 9.9 | 90.9 | 36.5 | 21.2 | 117.4 | 171.8 | 169.0 |
| UTILITES | 44.3 | 9.3 | 76.8 | 6.4 | 406.8 | 40.6 | 13.2 | 87.1 | 6258.4 | 105.0 |
| WHOLSALE | 120.6 | 42.7 | 56.3 | 194.8 | 981.2 | 136.5 | 61.3 | 18.5 | 224.9 | 205.9 |
| RETAIL | 6.6 | 4.1 | 2.6 | 157.9 | 15.4 | 3.5 | 16.1 | 3.0 | 26.3 | 31.4 |
| FINANCE | 106.2 | 56.3 | 68.3 | 32.9 | 349.5 | 62.9 | 54.7 | 206.8 | 345.6 | 228.1 |
| HOTELS | 0.1 | 0.0 | 1.8 | 0.7 | 28.1 | 25.2 | 0.4 | 20.7 | 11.6 | 45.7 |
| EATDRINK | 1.9 | 0.4 | 2.9 | 20.7 | 155.9 | 42.3 | 8.5 | 44.2 | 87.6 | 217.1 |
| AUTOSTAT | 8.8 | 1.8 | 10.7 | 12.9 | 57.0 | 9.2 | 62.8 | 18.4 | 91.6 | 148.0 |
| RECRATON | 0.0 | 0.0 | 0.0 | 0.2 | 1.3 | 0.6 | 0.1 | 139.3 | 1.3 | 1.0 |
| SERVICES | 178.9 | 38.6 | 66.9 | 150.9 | 688.8 | 181.0 | 68.2 | 252.0 | 575.9 | 414.2 |
| GOVERNMT | 0.6 | 0.1 | 2.5 | 1.5 | 86.0 | 22.0 | 13.3 | 40.2 | 120.5 | 46.2 |
| | | | | | | | | | | |
| INI INPT | 1769.0 | 203.5 | 377.7 | 894.7 | 5067.5 | 748.4 | 386.7 | 1076.9 | 10639.6 | 1719.7 |
| VALU ADD | 1619.3 | 674.2 | 1434.7 | 2582.9 | 14845.9 | 2995.6 | 1231.7 | 5427.5 | 16861.1 | 9550.4 |
| TOT INPT | 4655.0 | 1127.0 | 2337.0 | 5006.0 | 33427.0 | 5209.0 | 2059.0 | 7427.0 | 32647.0 | 12376.0 |
| N CMP IM | 262.3 | 183.5 | 395.2 | 1314.5 | 12335.0 | 1375.3 | 254.7 | 431.3 | 1697.2 | 744.6 |
| COMP IMP | 1004.4 | 65.9 | 129.4 | 213.8 | 1178.6 | 89.7 | 185.9 | 491.2 | 3449.1 | 361.3 |

F-1 - Transactions Table, Athens County, 1980

| | RETAIL | FINANCE | HOTELS | EATDRINK | AUTOSTAT | RECRATON | SERVICES | GOVERNMT |
|---|---|---|---|---|---|---|---|---|
| LIVESTOK | 0.0 | 0.0 | 0.0 | 211.3 | 0.0 | 3.6 | 205.2 | 0.0 |
| CROPS | 0.2 | 4.4 | 1.9 | 190.5 | 0.0 | 13.4 | 41.7 | 6.6 |
| MINING | 0.0 | 0.1 | 0.9 | 0.0 | 0.0 | 0.0 | 46.4 | 9.1 |
| CONSTRUT | 37.7 | 207.2 | 20.1 | 59.1 | 6.2 | 7.7 | 690.2 | 3252.1 |
| MANUFACT | 8.5 | 27.1 | 5.4 | 3736.2 | 19.4 | 3.2 | 974.5 | 39.3 |
| PRINTING | 22.8 | 368.7 | 9.4 | 41.1 | 0.1 | 2.7 | 378.0 | 67.4 |
| TRANSPRT | 14.7 | 24.6 | 2.6 | 133.3 | 3.5 | 1.8 | 187.8 | 56.2 |
| COMUNCAT | 117.6 | 498.1 | 5.1 | 88.9 | 11.6 | 5.8 | 741.6 | 169.1 |
| UTILITES | 441.1 | 457.0 | 111.2 | 698.9 | 17.6 | 16.7 | 2343.8 | 1631.1 |
| WHOLSALE | 102.1 | 129.5 | 17.8 | 2420.5 | 120.7 | 15.4 | 1201.3 | 168.7 |
| RETAIL | 23.0 | 40.9 | 5.6 | 1.4 | 25.0 | 1.9 | 67.9 | 75.0 |
| FINANCE | 709.3 | 3545.2 | 171.5 | 1131.6 | 67.8 | 58.4 | 4992.5 | 5381.8 |
| HOTELS | 2.5 | 34.2 | 0.3 | 0.0 | 0.2 | 0.8 | 124.2 | 7.2 |
| EATDRINK | 76.6 | 476.1 | 9.1 | 0.0 | 7.1 | 26.5 | 784.9 | 250.3 |
| AUTOSTAT | 72.4 | 85.7 | 8.7 | 11.0 | 4.3 | 3.4 | 307.1 | 52.9 |
| RECRATON | 0.9 | 4.5 | 0.1 | 119.0 | 0.1 | 74.5 | 92.4 | 2.2 |
| SERVICES | 349.0 | 2660.4 | 145.0 | 1169.0 | 45.9 | 57.5 | 4405.6 | 1071.2 |
| GOVERNMT | 101.8 | 702.4 | 10.1 | 69.2 | 2.6 | 2.9 | 489.3 | 38.6 |
| INT INPT | 2030.0 | 9266.2 | 524.7 | 10081.0 | 331.9 | 296.3 | 18074.6 | 7435.9 |
| VALU ADD | 12368.2 | 16986.5 | 1048.0 | 16820.1 | 1226.7 | 511.0 | 59572.9 | 11781.2 |
| TOT INPT | 15916.0 | 29747.0 | 1857.0 | 38993.0 | 2464.0 | 1058.0 | 91203.0 | 27241.0 |
| N CMP IM | 982.4 | 1321.0 | 151.8 | 9305.4 | 836.5 | 79.4 | 8841.5 | 2284.1 |
| COMP IMP | 485.3 | 2173.4 | 132.5 | 2786.5 | 68.9 | 171.3 | 4714.1 | 5739.8 |

F-1 - Transactions Table, Athens County, 1980

| | CNS DMND | OTHR F D | GRS OUTP |
|---|---|---|---|
| LIVESTOK | 248.196995 | 3136.256995 | 4655.000000 |
| CROPS | 926.416659 | -553.746675 | 1127.000000 |
| MINING | 22.664210 | -11.535700 | 2337.000000 |
| CONSTRUT | 0.0 | 0.000000 | 5006.000000 |
| MANUFACT | 35610.969629 | -9170.055956 | 33427.000000 |
| PRINTING | 977.888992 | 3128.697277 | 5209.000000 |
| TRANSPRT | 3522.151385 | -2317.705675 | 2059.000000 |
| COMUNCAT | 2197.933464 | 2961.614613 | 7427.000000 |
| UTILITES | 3682.353901 | 16199.492350 | 32647.000000 |
| WHOLSALE | 6513.025011 | -355.786150 | 12376.000000 |
| RETAIL | 17434.699701 | -2026.353596 | 15916.000000 |
| FINANCE | 25207.090223 | -8186.304947 | 29747.000000 |
| HOTELS | 801.985366 | 751.335048 | 1857.000000 |
| EATDRINK | 6399.209033 | 30381.798139 | 38993.000000 |
| AUTOSTAT | 2351.701939 | -854.401958 | 2464.000000 |
| RECRATION | 1479.488240 | -858.973642 | 1058.000000 |
| SERVICES | 16079.079561 | 62604.687950 | 91203.000000 |
| GOVERNMT | 2507.569583 | 22983.424985 | 27241.000000 |

THE MATRIX RANK IS: 18

F-2 - Technical Coefficients Table, Athens County, 1980

| | LIVESTOK | CROPS | MINING | CONSTRUT | MANUFACT | PRINTING | TRANSPRT | COMUNCAT | UTILITES | WHOLSALE |
|---|---|---|---|---|---|---|---|---|---|---|
| LIVESTOK | 0.070434 | 0.021185 | 0.0 | 0.0 | 0.014918 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| CROPS | 0.101446 | 0.013839 | 0.000001 | 0.000336 | 0.000123 | 0.000021 | 0.000007 | 0.000013 | 0.000036 | 0.000033 |
| MINING | 0.000021 | 0.001234 | 0.025086 | 0.003645 | 0.003185 | 0.000018 | 0.000002 | 0.0 | 0.063848 | 0.0 |
| CONSTRUT | 0.002598 | 0.003049 | 0.003557 | 0.000108 | 0.000886 | 0.001525 | 0.001473 | 0.014278 | 0.016590 | 0.001036 |
| MANUFACT | 0.095855 | 0.001661 | 0.006922 | 0.052265 | 0.042492 | 0.000469 | 0.001758 | 0.000085 | 0.000107 | 0.001296 |
| PRINTING | 0.000002 | 0.000003 | 0.000062 | 0.000036 | 0.000364 | 0.030983 | 0.001099 | 0.002048 | 0.000183 | 0.001195 |
| TRANSPRT | 0.007169 | 0.001825 | 0.001538 | 0.004709 | 0.004046 | 0.003094 | 0.028213 | 0.000998 | 0.002678 | 0.005115 |
| COMUNCAT | 0.001987 | 0.001756 | 0.000772 | 0.001980 | 0.002720 | 0.007004 | 0.010311 | 0.015809 | 0.005263 | 0.013059 |
| UTILITES | 0.009521 | 0.008249 | 0.032858 | 0.001284 | 0.012169 | 0.007792 | 0.006388 | 0.011721 | 0.191699 | 0.008466 |
| WHOLSALE | 0.025900 | 0.037861 | 0.024107 | 0.038914 | 0.029352 | 0.026199 | 0.029781 | 0.002495 | 0.006888 | 0.016037 |
| RETAIL | 0.001410 | 0.003638 | 0.001131 | 0.031542 | 0.000461 | 0.000677 | 0.007825 | 0.000408 | 0.000805 | 0.002357 |
| FINANCE | 0.022820 | 0.049913 | 0.029238 | 0.006566 | 0.010455 | 0.012068 | 0.026557 | 0.027840 | 0.010586 | 0.018432 |
| HOTELS | 0.000013 | 0.000015 | 0.000779 | 0.000137 | 0.000840 | 0.004833 | 0.000186 | 0.002786 | 0.000355 | 0.003695 |
| EATDRINK | 0.000399 | 0.000351 | 0.001235 | 0.004145 | 0.004664 | 0.008115 | 0.004104 | 0.005951 | 0.002683 | 0.017349 |
| AUTOSTAT | 0.001883 | 0.001593 | 0.004587 | 0.002572 | 0.001705 | 0.001765 | 0.030487 | 0.002483 | 0.002805 | 0.011957 |
| RECRATON | 0.000005 | 0.000001 | 0.000013 | 0.000033 | 0.000040 | 0.000119 | 0.000032 | 0.013749 | 0.000040 | 0.000030 |
| SERVICES | 0.038440 | 0.034264 | 0.028646 | 0.030150 | 0.020605 | 0.034752 | 0.033144 | 0.033931 | 0.017641 | 0.035471 |
| GOVERNMT | 0.000123 | 0.000107 | 0.001070 | 0.000308 | 0.002574 | 0.004230 | 0.006445 | 0.005407 | 0.003692 | 0.003750 |
| INT INPT | 0.380026 | 0.180544 | 0.161603 | 0.178728 | 0.151598 | 0.143666 | 0.187811 | 0.145001 | 0.325898 | 0.138432 |
| VALU ADD | 0.347873 | 0.598193 | 0.613898 | 0.515970 | 0.444128 | 0.575086 | 0.598225 | 0.730781 | 0.516466 | 0.771637 |
| TOT INPT | 1.000000 | 1.000000 | 1.000000 | 1.000000 | 1.000000 | 1.000000 | 1.000000 | 1.000000 | 1.000000 | 1.000000 |
| R CMP IM | *0.056340 | 0.162792 | 0.169112 | 0.262595 | 0.369014 | 0.264024 | 0.123694 | 0.058078 | 0.051987 | 0.080165 |
| COMP IMP | 0.215762 | 0.058471 | 0.055388 | 0.042708 | 0.035260 | 0.017225 | 0.090270 | 0.066139 | 0.105648 | 0.029496 |

F-2 - Technical Coefficients Table, Athens County, 1980

| | RETAIL | FINANCE | HOTELS | EATDRINK | AUTOSTAT | RECRATON | SERVICES | GOVERNMT |
|---|---|---|---|---|---|---|---|---|
| LIVESTOK | 0.0 | 0.0 | 0.0 | 0.005420 | 0.0 | 0.003392 | 0.002250 | 0.0 |
| CROPS | 0.000010 | 0.000148 | 0.000997 | 0.004885 | 0.000008 | 0.012677 | 0.000457 | 0.000242 |
| MINING | 0.0 | 0.000003 | 0.000475 | 0.0 | 0.0 | 0.0 | 0.000509 | 0.000333 |
| CONSTRUT | 0.002368 | 0.006967 | 0.010816 | 0.001515 | 0.002504 | 0.007286 | 0.007568 | 0.119382 |
| MANUFACT | 0.000535 | 0.000911 | 0.002908 | 0.095817 | 0.007862 | 0.003000 | 0.010685 | 0.001442 |
| PRINTING | 0.001433 | 0.012393 | 0.005056 | 0.001054 | 0.000044 | 0.002593 | 0.004145 | 0.002474 |
| TRANSPRT | 0.000921 | 0.000827 | 0.001403 | 0.003417 | 0.001408 | 0.001684 | 0.002059 | 0.002064 |
| COMUNCAT | 0.007387 | 0.016744 | 0.002728 | 0.002279 | 0.004691 | 0.005462 | 0.008131 | 0.006209 |
| UTILITES | 0.027712 | 0.015362 | 0.059905 | 0.017923 | 0.007128 | 0.015823 | 0.025699 | 0.059876 |
| WHOLSALE | 0.006417 | 0.004355 | 0.009569 | 0.062075 | 0.048989 | 0.014565 | 0.013172 | 0.006194 |
| RETAIL | 0.001443 | 0.001375 | 0.003041 | 0.000036 | 0.010136 | 0.001808 | 0.000744 | 0.002753 |
| FINANCE | 0.044565 | 0.119178 | 0.092331 | 0.029022 | 0.027529 | 0.055173 | 0.054740 | 0.019778 |
| HOTELS | 0.000155 | 0.001150 | 0.000163 | 0.0 | 0.000092 | 0.000790 | 0.001362 | 0.000264 |
| EATDRINK | 0.004811 | 0.016006 | 0.004887 | 0.0 | 0.002892 | 0.025034 | 0.008606 | 0.009187 |
| AUTOSTAT | 0.004548 | 0.002880 | 0.004705 | 0.000282 | 0.001760 | 0.003240 | 0.003367 | 0.001944 |
| RECRATON | 0.000059 | 0.000152 | 0.000035 | 0.003051 | 0.000021 | 0.070431 | 0.001013 | 0.000082 |
| SERVICES | 0.021928 | 0.089435 | 0.078068 | 0.029980 | 0.018614 | 0.054304 | 0.048306 | 0.039324 |
| GOVERNMT | 0.006397 | 0.023613 | 0.005456 | 0.001776 | 0.001040 | 0.002761 | 0.005365 | 0.001419 |
| INT INPT | 0.130689 | 0.311499 | 0.282543 | 0.258532 | 0.134719 | 0.280025 | 0.198179 | 0.272968 |
| VALU ADD | 0.777095 | 0.571032 | 0.564345 | 0.431363 | 0.497853 | 0.482970 | 0.653190 | 0.432480 |
| TOT INPT | 1.000000 | 1.000000 | 1.000000 | 1.000000 | 1.000000 | 1.000000 | 1.000000 | 1.000000 |
| N CMP IM | 0.061723 | 0.044407 | 0.081754 | 0.238642 | 0.339472 | 0.075081 | 0.096943 | 0.083848 |
| COMP IMP | 0.030494 | 0.073063 | 0.071358 | 0.071462 | 0.027956 | 0.161925 | 0.051688 | 0.210704 |

F-3 - Interdependence Coefficients Table, Athens County, 1980

THE "I-A INVERSE" MATRIX:

| | LIVESTOK | CROPS | MINING | CONSTRUT | MANUFACT | PRINTING | TRANSPRT | COMUNCAT | UTILITES | WHOLSALE |
|---|---|---|---|---|---|---|---|---|---|---|
| LIVESTOK | 1.080219 | 0.023379 | 0.000248 | 0.001035 | 0.016954 | 0.000201 | 0.000201 | 0.000274 | 0.000147 | 0.000283 |
| CROPS | 0.111190 | 1.016487 | 0.000074 | 0.000510 | 0.001928 | 0.000129 | 0.000096 | 0.000383 | 0.000114 | 0.000223 |
| MINING | 0.001821 | 0.002292 | 1.028725 | 0.004342 | 0.004551 | 0.000935 | 0.000854 | 0.001304 | 0.081505 | 0.000981 |
| CONSTRUT | 0.004670 | 0.004592 | 0.005368 | 1.001031 | 0.002177 | 0.003139 | 0.003617 | 0.016469 | 0.022103 | 0.002754 |
| MANUFACT | 0.109677 | 0.005307 | 0.008604 | 0.055928 | 1.047255 | 0.002273 | 0.003580 | 0.002458 | 0.002826 | 0.004096 |
| PRINTING | 0.000897 | 0.001092 | 0.000788 | 0.000525 | 0.000806 | 1.032514 | 0.001943 | 0.002929 | 0.000699 | 0.001878 |
| TRANSPRT | 0.009099 | 0.002570 | 0.002103 | 0.005499 | 0.004847 | 0.003680 | 1.029515 | 0.001440 | 0.003870 | 0.005680 |
| COMUNCAT | 0.004648 | 0.004095 | 0.002514 | 0.003694 | 0.004125 | 0.008651 | 0.012635 | 1.017514 | 0.007672 | 0.015287 |
| UTILITES | 0.019036 | 0.014435 | 0.044663 | 0.006039 | 0.013553 | 0.013279 | 0.012232 | 0.018439 | 1.242849 | 0.014222 |
| WHOLSALE | 0.038021 | 0.041614 | 0.027273 | 0.043019 | 0.033290 | 0.029460 | 0.034482 | 0.005395 | 0.012879 | 1.020147 |
| RETAIL | 0.002458 | 0.004183 | 0.001610 | 0.031905 | 0.000812 | 0.001037 | 0.008724 | 0.001164 | 0.001974 | 0.002971 |
| FINANCE | 0.041095 | 0.062992 | 0.038408 | 0.013935 | 0.016593 | 0.019188 | 0.037021 | 0.037661 | 0.020928 | 0.026607 |
| HOTELS | 0.000402 | 0.000335 | 0.001034 | 0.000435 | 0.001088 | 0.005215 | 0.000480 | 0.003002 | 0.000650 | 0.003922 |
| EATDRINK | 0.002986 | 0.002684 | 0.002953 | 0.005965 | 0.006147 | 0.009792 | 0.006170 | 0.007893 | 0.004506 | 0.019007 |
| AUTOSTAT | 0.003551 | 0.002690 | 0.005535 | 0.003727 | 0.002620 | 0.002609 | 0.032257 | 0.003106 | 0.004407 | 0.012758 |
| RECRATON | 0.000187 | 0.000159 | 0.000127 | 0.000181 | 0.000185 | 0.000393 | 0.000370 | 0.020606 | 0.000262 | 0.000510 |
| SERVICES | 0.056623 | 0.046155 | 0.037358 | 0.037494 | 0.027563 | 0.042469 | 0.042946 | 0.043186 | 0.029685 | 0.041151 |
| GOVERNMT | 0.002035 | 0.002156 | 0.002560 | 0.001451 | 0.003523 | 0.005350 | 0.008117 | 0.006853 | 0.005498 | 0.004942 |

F-3 - Interdependence Coefficients Table, Athens County, 1980

THE "I-A INVERSE" MATRIX:

| | RETAIL | FINANCE | HOTELS | EATDRINK | AUTOSTAT | RECRATON | SERVICES | GOVERNMT |
|---|---|---|---|---|---|---|---|---|
| LIVESTOK | 0.000146 | 0.000487 | 0.000409 | 0.007732 | 0.000244 | 0.004741 | 0.002882 | 0.000362 |
| CROPS | 0.000090 | 0.000401 | 0.001174 | 0.005854 | 0.000085 | 0.014522 | 0.000883 | 0.000420 |
| MINING | 0.002504 | 0.002043 | 0.005935 | 0.002169 | 0.000837 | 0.001890 | 0.003060 | 0.005966 |
| CONSTRUT | 0.004763 | 0.013096 | 0.014987 | 0.003332 | 0.003644 | 0.010331 | 0.010317 | 0.121863 |
| MANUFACT | 0.001965 | 0.005264 | 0.006073 | 0.101993 | 0.009359 | 0.008377 | 0.013975 | 0.010045 |
| PRINTING | 0.002378 | 0.015311 | 0.007185 | 0.001948 | 0.000726 | 0.004274 | 0.005523 | 0.003248 |
| TRANSPRT | 0.001311 | 0.001651 | 0.002249 | 0.004626 | 0.001944 | 0.002569 | 0.002730 | 0.003270 |
| COMUNCAT | 0.009158 | 0.021155 | 0.006413 | 0.004880 | 0.006545 | 0.008590 | 0.010624 | 0.008301 |
| UTILITIES | 0.037574 | 0.028906 | 0.081170 | 0.027368 | 0.011872 | 0.026943 | 0.036896 | 0.077979 |
| WHOLSALE | 0.008615 | 0.009754 | 0.014275 | 0.068281 | 0.051491 | 0.021195 | 0.017046 | 0.014111 |
| RETAIL | 1.001837 | 0.002289 | 0.003978 | 0.000581 | 0.010535 | 0.002667 | 0.001404 | 0.006871 |
| FINANCE | 0.054346 | 1.145816 | 0.113908 | 0.040010 | 0.035442 | 0.075800 | 0.068710 | 0.029520 |
| HOTELS | 0.000349 | 0.001667 | 1.000570 | 0.000481 | 0.000396 | 0.001183 | 0.001677 | 0.000519 |
| EATDRINK | 0.006416 | 0.020207 | 0.008350 | 1.002957 | 0.004821 | 0.029496 | 0.010996 | 0.011290 |
| AUTOSTAT | 0.005148 | 0.004149 | 0.005987 | 0.001832 | 1.002763 | 0.006514 | 0.004313 | 0.003124 |
| RECRATON | 0.000316 | 0.000811 | 0.000526 | 0.003455 | 0.000211 | 1.076133 | 0.001424 | 0.000365 |
| SERVICES | 0.030612 | 0.112666 | 0.091072 | 0.042009 | 0.026197 | 0.073009 | 1.061043 | 0.051613 |
| GOVERNMT | 0.008136 | 0.028119 | 0.009189 | 0.003662 | 0.002416 | 0.005529 | 0.007713 | 1.002950 |

## Appendix G

The estimation of different increase or decrease in tourist purchases can be done using Table 2. For example, support tourist purchases increase by 15 percent. This is a 50 percent increase over the estimation in Table 2.

The following steps will estimate the changes:

(1) $\frac{15}{10}$ X 100 = 150%

(2) Increase in each sector's output: 150% X column 1

For example: increase in livestock sector's output is

150% X 4,700 = $7,050

(3) Increase in each sector's employment: 150% X column 2

For example: increase in livestock sector's employment is

150% X .2 = .3

(4) Increase in each sector's income: 150% X column 3

For example: increase in livestock sector's income is

150% X 1,900 = $4,350

The same can be done if there is decrease in tourists purchases.